

Sex Ratio of Adult Head Lice¹ Under Crowded Conditions²

JAMES D. LANG³

DEPARTMENT OF ENTOMOLOGY, UNIVERSITY OF ARIZONA, TUCSON 85721

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Abstract: The shortened life expectancies of female head lice, *Pediculus humanus capitis* DeGr., due to increased copulations by males when overcrowded, was examined in natural and reared louse populations. Natural populations were too small to verify if a detrimental influence upon females by males does occur, while the number of reared females was not significantly reduced in the denser populations indicating female longevity does not decrease when overcrowded. Results from individually isolating newly emerged females with a number of like males showed the former survived a considerably shorter time than their normal life expectancies. The shortened lives of these females was attributed to their not being fully sclerotized prior to copulating, causing injury and death, and not as the result of frequent copulations by males.

The ratio of adult male head lice, *Pediculus humanus capitis* DeGr., to females on lightly and heavily infested individuals was examined in several studies. Examination of complete crops of hair of 125 infested male prisoners from Colombo, Ceylon, showed that those (49) with 1–2 adult lice had 70% females; those (13) with 26–100 adults bore 50%; while those (9) with 101 or more yielded 40% females (Buxton 1937). This significant decrease of females was attributed to more frequent copulations by males in the denser populations, which injured females and shortened their lives, thus reducing their numbers (Buxton 1941). Buxton believed that a difference in female mortality begins when the number of adults per head is between 25 and 100 and is greatly increased when the total exceeds 100. Crops of infested hair from Kakamega, Kenya, and from Lagos, Nigeria, were also examined which yielded no decrease of females on those with higher louse densities (Buxton 1941).

In another study, head lice collected from 67 infested refugees revealed that those (37) with 1–50 adults harbored 75% females; those (7) with 51–100 adults yielded 76%; those (20) with 101–500 had 74%; two individuals with 501–1000 embodied 79%; while one infested with 1434 adults yielded 83% females (Roy and Ghosh 1944). These findings thus show that females were not reduced under more crowded conditions in contrast to the above studies.

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³ Present address: Department of Entomology, University of California, Riverside, CA 92502.

In the present study, the detrimental influence of male head lice upon females under crowded conditions is examined in natural and reared populations.

METHODS

The sex ratio of adult head lice in natural populations was studied by collecting crawling stages from 93 Tucson school children. Students were thoroughly examined to ascertain that all or the majority of lice were removed. The number and sex of adults was then determined for each host individual examined.

The female/male ratio of reared lice was examined by counting various generations of a colony maintained in a modified pill bottle (Lang and Roan 1975). The colony was initiated with three males and seven females collected from an individual and terminated at F_{27} .

The longevity of female lice in the presence of males was examined by isolating a newly emerged female with two newly emerged males in a rearing container similar to the one used for the parent stock. This procedure was repeated 10 times using different lice.

RESULTS AND DISCUSSION

Forty-six of the 93 infested children yielded adult lice. Results showed that 29 individuals, each with 1–5 adults, yielded 69% females; those (11) with 6–10 had 66%; those (5) with 11–15 had 63%; while one with 18 adults bore 64% females. Chi-square analysis showed no significant decline of females on individuals with higher adult numbers. The low adult numbers on these individuals, however, could not adequately verify if higher louse densities do have a detrimental influence upon females.

The percentage of female lice determined for different reared generations in a colony is depicted in Table 1. The lack of a significant decrease of females in the denser generations examined, particularly for F_{20} and F_{27} which were very overcrowded in the rearing container, indicates that denser populations do not yield a lower number of females due to increased copulations.

Individual female lice kept with males survived on the average 14 days, while the normal life expectancies for newly emerged females isolated by themselves averaged 30 days (Lang 1975). Duncan's Multiple Range test showed a significant difference (5% level) for survival periods of females kept with males, compared to those isolated. A similar experiment was conducted by Buxton (1940) employing body lice, *P. h. humanus* Linn. His results showed that mean life expectancies for newly emerged females, individually isolated with 4 to 18 newly emerged males, was about 10 days. He also found that life expectancies for mature females, individually kept with a similar number of males, did not appear to be reduced.

The premature deaths of newly emerged females isolated with males may be the result of their not being fully sclerotized prior to copulating, so that injury

TABLE 1. Percentage of female head lice, *Pediculus humanus capitis*, occurring in reared generations.

Generation	No. Adults	Females (%) ¹
F ₃	112	68
F ₅	169	65
F ₁₅	210	61
F ₂₀	430	62
F ₂₇	326	58

¹ Chi-square value = 2.172 with 4 degrees of freedom, while expected Chi-square value = 9.488.

and death occurs. This is supported by Buxton's (1940) findings for the apparently normal longevities of mature females kept with males.

Buxton (1941) concluded that the sex ratio of lice is evidently determined by the chromosomes alone and found no evidence that any environmental factor effects sex ratio except when a female encounters a male very frequently. Roy and Ghosh (1944), however, disagreed with this latter statement since they found no decline of females on those moderately or even heavily infested, even though the majority of these individuals supported very heavy infestations.

Results from the present study concerning reared populations, some of which were very overcrowded, also refute Buxton's (1941) findings that higher louse densities decrease female numbers due to more frequent copulations. It thus appears that chromosomes alone do determine the ratio of sexes in head louse populations, although Buxton's (1941) Colombo study, showing a significant decrease of females from lightly to heavily infested individuals, is the only data found disagreeing with this concept.

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